being unpatentable over claims 6-13 of U.S. Patent No. 5,764,324 (Lu). Applicants respectfully traverse these rejections based on the following discussion.

I. The Prior Art Rejections

A. The Rejection Based on Yasukawa

1. The Position In the Office Action

With respect to the rejection of claims 1-3, 7-10, 14-17, the Office Action states that Yasukawa discloses (col. 15, lines 25-52; col.6, line 48 - col.7, line 52; Figs. 7 and 1) a reflective liquid crystal panel comprising a counter electrode (common electrode) composed of a transparent electrode (ITO) (33), i.e., a first-type electrode or a transmissive electrode; a reflective electrode (pixel electrode 14), i.e., a second-type electrode or a reflective electrode positioned opposite the transmissive electrode (the transmissive electrode is an opposite type of the reflective electrode); a liquid crystal material (37) between the transmissive electrode (33) and the reflective electrode (14); a passivation film (17) formed on the entire pixel electrode (14) which is adjacent the liquid crystal material; and that the passivation film (17) is composed of a silicon oxide film.

The Office Action declares that because the amorphous layer (or the amorphous carbon layer) comprises a silicon oxide, that Yasukawa discloses that an amorphous layer comprises silicon oxide film as the passivation film. The Office Action recites that Yasukawa indicates (col. 7, lines 20-23) that the use of a silicon oxide film as the passivation film (17) covering the pixel region prevents significant change in reflectance due to the variation of film thickness and the wavelength of the light, such that preventing the display flickers. On the other hand, the Office Action notes that any material has conductivity. The Office Action states that using SiO_2 as the amorphous layer or the amorphous carbon layer as claimed in claims 1, 8, and 15 also have

slight conductivity, so that the material also is a conducting (slight conductivity) material. The Office Action concludes that the diamond-like conductive film has a very slight conductivity Therefore, the material using SiO_2 met the claims 1, 8 and 15.

With respect to claims 5, 12 and 19, the Office Action declares that Yasukawa discloses (col. 7, lines 37-38) that a polyimide alignment film is formed on the entire passivation film (17), i.e., a polyimide layer is formed between the passivation film (as the amorphous layer) and the liquid crystal material.

2. The Yasukawa Reference

Yasukawa discloses a liquid crystal substrate in which a matrix of reflecting electrodes is formed. A transistor is formed corresponding to each reflective electrode and a voltage is applied to the reflective electrode through the transistor. A silicon oxide film having a thickness of 500 to 2,000 angstroms is used as a passivation film and the thickness is set to a value in response to the wavelength of the incident light to maintain a substantially constant reflectance.

3. Applicants' Response

Yasukawa does not teach or suggest the use of a diamond-like conductive film adjacent one or both of the electrodes in a reflective LCD device as in the claimed invention. To the contrary, Yasukawa requires that an insulator (silicon oxide) be positioned as a passivating layer next to the electrodes. On pages 7 and 8, the Office Action argues that, in response to Applicants' previously filed amendment, Yasukawa discloses the claimed invention by using a silicon oxide film 17. More specifically, the Office Action states that "any material has conductivity. Using SiO2 as the amorphous layer or the amorphous carbon layer as claimed in claims 1, 8 and 15 also have supplied conductivity, so that the material also is a conducting (slight cannot activity) material. The diamond-like conductive film has a very slight conductivity

". In other words, the Office Action argues that the amorphous insulator 17 disclosed in Yasukawa teaches the "conducting amorphous layer" (claims 1 and 15) and "conducting amorphous diamond-like carbon layer" (claim 8).

Applicants agree that claim language should be interpreted broadly during examination; however, such an interpretation cannot reach the point of being so broad as to contradict the clear meaning of the term being interpreted. Here, the claims clearly define a "conducting" layer. Silicon dioxide is an insulator, unless modified (as with carbon) so that it changes its insulating characteristics.

The Office Action urges that the silicon oxide insulator disclosed in Yasukawa should be considered a conductor because all materials have some level of conductivity, no matter how slight. Applicants respectfully disagree that silicon oxide should be classified as a conductor for a number of reasons, the first and foremost of which is that silicon oxide (and silicon dioxide) are categorized by those skilled in this art field as insulators. Silicon oxide is not used as a conductor. Further, Yasukawa uses the silicon dioxide layer 17 as an insulator and calls the layer a "passivating layer". Yasukawa uses silicon oxide to prevent significant change in reflectance due to the variation of film thickness and wavelength of light. Therefore, not only is the Office Action urging a meaning of silicon oxide that is contrary to the well-known meaning, it is also contrary to the meaning intended in the reference.

Further, the Office Action argues that silicon oxide has a "slight" amount of conductivity. However, this language is not included in the claims. To the contrary, the claims merely define a "conducting amorphous layer" (claims 1 and 15) and "conducting amorphous diamond-like carbon layer" (claim 8). The terminology "slightly conducting" is not used in the independent claims. Therefore, the position in the Office Action is additionally erroneous because it is reading limitations into the claims that are not there.

In addition, the Office Action proposes that since some of the dependent claims define the conducting amorphous layer as including ("comprising") silicon dioxide that silicon dioxide should be considered a conductor. But, Applicants submit that this logic is flawed because of the

legal meaning of the word "comprising". More specifically, the dependent claims define that the amorphous layer can "comprise" a number of substances one of which is a silicon dioxide. This is legally interpreted to mean that one of the elements within the layer is silicon dioxide. This does not mean that the layer is exclusively silicon dioxide. Instead, if Applicants had intended such a meaning, they would have used more restrictive language such as "consisting of" or "consisting essentially of". The paragraph appearing on page, lines 10-15, explains that the silicon dioxide layer is changed from an insulator into a conductor using a form of carbon.

As shown above, Applicants respectfully submit that in attempting to broadly interpret the claim language and the teachings of the prior art, that the Office Action has exceeded what is permitted. More specifically, classifying the passivating layer of silicon dioxide in Yasukawa as a conductor exceeds the boundaries permitted on broad interpretation. The claims clearly and unambiguously define a "conducting amorphous layer" (claims 1 and 15) and "conducting amorphous diamond-like carbon layer" (claim 8). To the contrary, Yasukawa discloses a passivating layer 17, nothing more. Therefore, Yasukawa does not teach or suggest the claimed invention.

As explained in column 16, lines 51-59 of Yasukawa, the prior art requires a passivating insulator 17. This requirement to use an insulator 17 teaches away from the claimed invention which uses a "conducting amorphous" layer adjacent at least one of the electrodes. Therefore, Yasukawa does not teach or suggest the invention as defined by independent claims 1, 8, or 15 and these independent claims are patentable over Yasukawa. Further, dependent claims 2, 3, 5, 9, 10, 12, 14, 16, 17, and 19 are similarly patentable, not only by virtue of their dependency from a patentable independent claim, but also by virtue of the additional features of the invention they define. In view the forgoing, the Examiner is respectfully requested to reconsider and withdraw this rejection.

B. The Rejection Based on Yasukawa in view of Hanihara

1. The Position in the Office Action

With respect to claims 4, 11, and 18, the Office Action states that it was known that the silicon oxide film can be an alignment film. The Office Action argues that Hanihara discloses (col.5, lines 52-53) that an alignment film (8) made of silicon oxide is formed on the electrode (7), such that the silicon oxide film has a function to be an alignment film. The Office Action declares that because the amorphous layer comprises silicon oxide, that the amorphous layer made of silicon oxide has a unidirectional orientation matched to the liquid crystal material. Therefore, the Office Action concludes that an alignment film as claimed in claims 4, 11 and 18 would have been at least obvious.

2. The Hanihara Reference

Hanihara discloses a liquid crystal display device that has a semiconductor substrate. A plurality of switching elements are arranged on the substrate in a matrix, and a plurality of pixel electrodes are provided above the switching elements and arranged in matrix corresponding to the switching elements. A liquid crystal layer is provided on the pixel electrodes. The switching element is connected with a corresponding pixel electrode by a wiring layer. Dummy layers are provided in the same level as the wiring layer so that a surface of the dummy layer is substantially flush with a surface of the wiring layer.

3. Applicants' Response

Hanihara does not cure the deficiency of Yasukawa shown above. More specifically, Hanihara does not teach or suggest the conductive amorphous layer defined by independent

claims 1, 8, and 15. Indeed, Hanihara is only referenced for showing that silicon oxide has a unidirectional orientation matched to the liquid crystal material and is not intended to teach or suggest a diamond-like conductive amorphous layer. Therefore, any combination of Hanihara and Yasukawa would not teach or suggest "a conducting amorphous layer adjacent said liquid crystal material"; "a conducting amorphous diamond-like carbon layer adjacent said liquid crystal material"; or "forming a conducting amorphous layer on at least one of said first-type electrode and said second-type electrode adjacent said liquid crystal material," as defined by independent claims 1, 8, and 15, respectively.

Therefore, independent claims 1, 8, and 15 are patentable over any combination of Yasukawa and Hanihara. Further, dependent claims 4, 11, and 18 are similarly patentable, not only by virtue of their dependency from a patentable independent claim, but also by virtue of the additional features of the invention they define. In view the forgoing, the Examiner is respectfully requested to reconsider and withdraw this rejection.

C. The Rejection Based on Yasukawa in view of Admitted Prior Art (Lu)

1. The Position in the Office Action

With respect to claims 6, 13, and 20, the Office Action states that it was known that the voltage between the pixel electrode and the common electrode varies the transparency of the liquid crystal material. The Office Action argues that Applicants' admitted prior art discloses (col. 3, lines 1-4 in the specification) that varying the voltage to the electrode (106) (the pixel electrode) controls the liquid crystal cell (111) such that different amount of light are transmitted across the liquid crystal display (different transparency of liquid crystal material), thus resulting in the display of a gray scale of light. Therefore, the Office Action concludes that a voltage between the transmissive electrode and the reflective electrode varies the transparency of the liquid crystal material as claimed in claims 6, 13, and 20 would have been at least obvious.

2. The Lu Reference

Lu discloses a reflective liquid crystal cell for AMLCDs, wherein the reflective electrode may be passivated with an insulating film such as silicon oxide. In addition, the liquid crystal cell may include a conducting transparent electrode that has a work function substantially equal to the work function of the reflective electrode in the cell. The reflective electrode may include a transparent conductive layer such as ITO, or may include an integer number of film pairs, wherein the film pair comprises a first dielectric film having a low index of refraction and a second dielectric film having a high index of refraction.

3. Applicants' Response

Neither Lu, Hanihara, nor Yasukawa teach or suggest the conductive amorphous layer defined by independent claims 1, 8, and 15. Lu teaches using the same material of one electrode (the transparent one) to cover the other to balance work function. Indeed, Lu and Yasukawa affirmatively teach away from the claimed invention by requiring a passivating insulator adjacent the electrodes. Lu teaches the use of a conducting layer to balance the work function. Due to this layer's high conductivity, an extra photolithographic step is required in Lu to avoid shorting the pixels together. Such processing is very difficulty to achieve. As shown above, the claimed invention is fundamentally different than any of the teachings in the prior art. The invention avoids flicker LCD problems by using a conducting thin film, e.g., diamond-like carbon (DLC) film, coated on both the Al and ITO electrodes of reflective LCDs to reduce and stabilize the Vcom shift. The conducting film allows electrical charges to flow toward the electrodes and bend the Fermi level of the adjacent electrode and balance the surface potential. Thus, with the invention, the Vcom shift is small and stable so that the display can be operated in the frame-inversion drive with a frame rate lower than 70 Hz without perceivable flicker.

Such features are simply not taught or suggested by the prior art of record. More specifically, none of the applied references teaches or suggests "a conducting amorphous layer

adjacent said liquid crystal material"; "a conducting amorphous diamond-like carbon layer adjacent said liquid crystal material"; and "forming a conducting amorphous layer on at least one of said first-type electrode and said second-type electrode adjacent said liquid crystal material," as defined by independent claims 1, 8, and 15, respectively.

Therefore, independent claims 1, 8, and 15 are patentable over any combination of Yasukawa and Lu. Further, dependent claims 6, 13, and 20 are similarly patentable, not only by virtue of their dependency from a patentable independent claim, but also by virtue of the additional features of the invention they define. In view the forgoing, the Examiner is respectfully requested to reconsider and withdraw this rejection.

D. The Double Patenting Rejection

1. The Position in the Office Action

The Office Action states that claims 1-20 are rejected under the judicially created doctrine of obviousness type double patenting as being unpatentable over claims 6-13 of U.S. Patent No. 5,764,324 (Lu et al). The Office Action argues that although the conflicting claims are not identical, they are not patentably distinct from each. The Office Action states that claims 1-20 of the application and the claims 6-13 of the U.S. Patent No. 5,764,324, except for a few wording differences, are substantially the same.

The Office Action recites that the claims 1-20 of the application claim a reflective-type liquid crystal display comprising a transmissive electrode; a reflective electrode; and a liquid crystal material between the transmissive electrode and the reflective electrode; where at least one of the transmissive electrode and the reflective electrode includes an amorphous layer (or amorphous carbon layer) adjacent the liquid crystal material, and that the amorphous (or amorphous carbon layer) comprises a silicon oxide (SiO_2).

The Office Action further contends that claims 6-13 of the US 5,764,324 also have such limitations as a liquid crystal cell for a liquid crystal display device comprising a transparent electrode; a reflective electrode; and a liquid crystal material disposed between the transparent electrode and the reflective electrode; and at least one layer of dielectric material disposed between a transparent conductive layer and a reflecting metal layer, and the dielectric material comprises silicon dioxide, such that a silicon oxide film as a passivation film covering the pixel electrode.

2. Applicants' Response

Lu affirmatively claims a "dielectric material" adjacent the reflective electrode (claim 6). As shown above this teaches away from the invention that uses a "conductive" amorphous layer adjacent at least one of the electrodes. Therefore, there is a substantial difference between the claimed invention in Lu and the present invention. More specifically, the present invention which claims "a conducting amorphous diamond-like layer adjacent said liquid crystal material"; "conducting amorphous carbon layer adjacent said liquid crystal material"; and "forming a diamond-like conducting amorphous layer on at least one of said first-type electrode and said second-type electrode adjacent said liquid crystal material," as defined by independent claims 1, 8, and 15, respectively, is patentably distinct (and patentable over) the invention defined by claims 6-13 of Lu. In view the forgoing, the Examiner is respectfully requested to reconsider and withdraw this rejection.

09/296,588
YO998-532

II. Formal Matters and Conclusion

In view of the foregoing, Applicants submit that claims 1-20, all the claims presently pending in the application, are patentably distinct from the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary.

Please charge any deficiencies and credit any overpayments to Attorney's Deposit Account Number 50-0510.

Respectfully submitted,

Dated: 9/12/02

Frederick W. Gibb, III
Reg. No. 37,629

McGinn & Gibb, PLLC
2568-A Riva Road
Suite 304
Annapolis, MD 21401
(301) 261-8071
Customer Number: 28211